

OBSTRUCTIVE SLEEP APNOEA AND MAXILLOFACIAL SURGERY

ABSTRACT

Obstructive sleep apnoea (OSA) is a disease of the upper airways that leads to a cessation of or a significant decrease in breathing during sleep leading to increased fatigue, difficulty in concentrating and in some cases leading to cardiovascular diseases and even stroke. It affects millions of people around the world. This condition in many of the individuals remain undiagnosed while those who are diagnosed often exhibit poor compliance with the use of Continuous Positive Air Pressure (CPAP), a very effective non-invasive modality. Maxillo-mandibular advancement (MMA) surgery is the most successful treatment for the severe form of this disease. This article reviews various Oral and Maxillofacial management options for the treatment of OSA.

Keywords: Obstructive Sleep Apnea, Maxillo-Mandibular Advancement, Continuous positive airway pressure.

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Obstructive sleep apnoea (OSA) is a disease of the upper airway that leads to a cessation of or a significant decrease in breathing during sleep leading to increased fatigue, difficulty in concentrating and in some cases leading to cardiovascular diseases and even stroke. The term orthognathic is derived from the Greek word “ortho”- straight and “gnathos”- jaw. It includes a wide range of maxillary and mandibular osteotomies done for the correction of deformities of the facial skeleton to achieve proper form, function, and esthetics. Maxillo-mandibular advancement surgery (upper and lower surgical jaw repositioning) is the most successful treatment of the severe form of the disease.

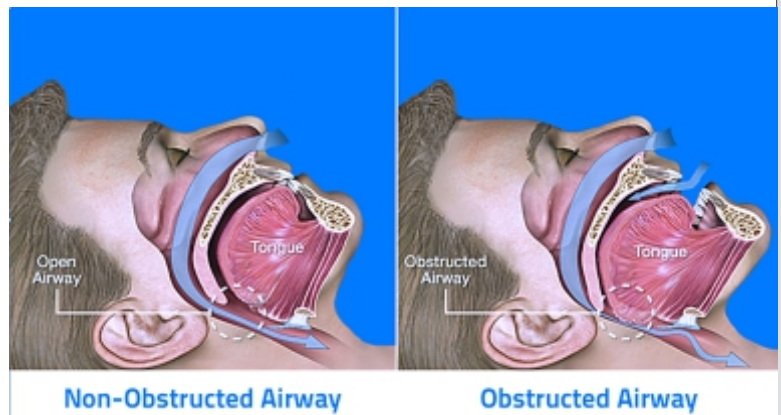
Obstructive sleep apnoea is a chronic disruptive condition in which the person experiences many pauses and episodes of shallow breath while asleep. Pauses in breathing can last a few seconds to a few minutes and typically followed by a choking sound. The disruption in normal breathing results in poor quality sleep which may lead to disastrous results. This potentially life threatening disease affects 12% of the adult population. Adults are not the only ones affected with estimates putting the children affected by this condition at around 3%. Nearly 80% of all moderate to severe sleep apnoea cases are undiagnosed according to the American sleep apnoea Association.

Diagnosis:

Most of those affected by this condition is made aware by family members. To correctly diagnose OSA the person should see a doctor or a specialist who will make a diagnosis based on the existing signs and symptoms, family history, further examination, or get additional analysis from a sleep specialist. At a sleep center, monitored sleep studies can be administered to a patient to diagnose sleep apnoea and other sleep disorders. The test for diagnosing sleep apnoea is polysomnogram (PSG). It records various relevant biometrics, eye movements, heart rate, blood pressure etc. The results are reviewed by a sleep specialist who will make a diagnosis and help patients with appropriate treatment plan.

Signs of sleep apnoea

1. Daytime fatigue and sleepiness
2. Difficulty in concentration during daytime
3. Disruptive snoring
4. Pauses in breath while sleeping
5. Waking up to a dry mouth or sore throat
6. Waking up with a headache
7. Mood swings
8. Irritability
9. High blood pressure
10. Night time sweating



What happens?

Pharynx is the most common site of obstruction. This may be due to large tongue size, small airway or abnormal anatomy.¹ People with OSA have disrupted sleep and low blood oxygen levels. When OSA occurs, the tongue is sucked against the back of the throat. This blocks the upper airway and airflow stops. When the oxygen level in the brain becomes too low the carotid sinus is stimulated, and the sleeper partially awakens. The obstruction in the throat then clears and the flow of air starts again usually accompanied by a loud gasp. This apneic episode can go on from 5 - 100 times a night or even more. The average number of episodes per hour of sleep is called Apnea-Hypopnea Index (AHI) and is classified into mild (5-15), moderate (15-30) and severe (>30).² These episodes are frequently associated with snoring, but it is not considered to be a diagnostic factor.

Repeated cycles of decreased oxygenation may lead to very serious cardiovascular problems. They may

also suffer from excessive daytime sleepiness, depression and loss of concentration. Some have a less severe obstruction called upper airway resistance syndrome (UARS). In either case the individual suffering may have the same symptoms.

The first step in treatment is to recognize the symptom and seek consultation. Oral and maxillofacial surgeons can offer consultation and treatment options. In addition to a detailed history, the doctor will assess the anatomic relationship in the maxillofacial region. With cephalometric analysis the doctors can assess the level of obstruction. Sometimes a nasopharyngeal examination is done with a flexible fibro-optic camera. To confirm the amount of cardiovascular compromise and in case of decreased oxygen levels, a sleep study may be done to monitor the individual overnight.

Examination should include assessment of systolic and diastolic blood pressure, neck girth, evaluation of upper airway to assess the status of uvula, soft palate, tonsils and tongue size, low level of hyoid bone or maxillo-mandibular deficiency.³

Mallampati Score (Grade 1- 4) evaluates the size of the tongue in relation to the oral cavity. An increased score suggests that tongue could be the cause of obstruction.⁴ Epworth sleepiness scale is a questionnaire used as a subjective measure of a patient's daytime sleepiness. There are many other grading systems which may be used to assess sleep and apnoea.

Lateral cephalometric radiographs are used to assess the size of the posterior airway space, the length of the soft palate and the distance from the mandible to the hyoid bone which are beneficial for decisions concerning surgical management. Cephalometric analysis is very important in OSA patients in diagnosis and treatment planning.⁵ Cone-beam computed tomography (CBCT) scans can be used to assess anatomic deformities.⁶ Polysomnography is the gold standard test. It is a detailed overnight sleep study which records many functions like brain activity, oxygen saturation, heart rhythm, breathing rate, muscle activity and eye movements. Respiratory disturbance index (RDI), AHI and oxygen desaturation index (ODI) are also used as a screening and diagnostic test.⁷

Treatment

There are several treatment options available ranging from noninvasive to invasive methods. The initial treatment may consist of using nasal continuous positive airway pressure (CPAP) machine that delivers pressurized oxygen through a nasal mask to limit obstruction at night. The non-invasive treatment options include life style modification, postural training and oral appliance therapy.

Oral Appliance (OA) Therapy for lower jaw advancement

Different types of dental splints are available to treat mild to moderate obstructive sleep apnoea (OSA). It looks similar to a sports mouth guard and is worn over the upper and lower teeth during sleep. It is suitable for patients with mild to moderate OSA, mainly with tongue level obstruction. The patient's gums and teeth must be healthy and stable in order for the dental splint to anchor well and push the lower jaw forward.

OA positions the lower jaw forward to open up the airway at the back of the tongue. Adjustments may be necessary in the first few months and the OA may need to be replaced after an average of 5 years.



An adult fitted with an adjustable OA with connectors at the side.



A Tap-T oral appliance with a connector in front.

Surgical Options

Surgery is sometimes recommended for severe cases of obstructive apnoea. It is the next option for patients with moderate to severe OSA who are non-compliant to CPAP therapy. Patients must be medically fit to undergo surgery.

All cases for surgery are examined thoroughly in order to customize the treatment plan. Soft and hard tissue surgery are planned to cater to the needs of each patient. In many instances, a multidisciplinary

approach is taken and a team of surgeons is brought in for combined surgery. Sometimes, it may be necessary to stage surgical treatment into separate surgeries done at different times. Oral and maxillofacial surgeons carry out jaw surgery. The otolaryngology (ear, nose and throat) surgeons carry out surgeries to the nose, palate and throat.

Invasive therapy includes surgeries such as uvulopalato-pharyngo-plasty (UPPP), laser assisted uvulopalatoplasty (LAUP), hyoid suspension and tongue base reduction. Common oral and maxillofacial approaches include genioglossus advancement (GGA), advancement genioplasty, maxillomandibular advancement (MMA) and distraction osteogenesis (DO).⁸ The definitive and accepted treatment for OSA is Continuous positive airway pressure (CPAP) but this has a high non-compliance rate.⁹ The side effects include the stuffy dry nose, nasal irritation, claustrophobia, noise from the machine, disturbed sleep, unintentional removal of the apparatus during sleep, difficulty in initiating sleep and gastric disorders. Studies comparing oral appliances (OA) and CPAP have shown that the former is less effective (15-55% success), but owing to the side effects of CPAP, patients prefer oral appliances.¹⁰

The surgical procedures can be divided into 2 stages.

Stage I includes UPPP and GGA, with or without hyoid myotomy.

Stage II includes MMA and is carried out where stage I surgeries may not change the status of the patient. The main aim of the surgical therapy is to cure the disease but it is accompanied by complications such as the post-operative pain, discomfort, edema, risk of surgery and the uncertainty of the success of the procedure.

1. Genioglossus Advancement with/without Hyoid Myotomy - The surgery focuses on either the reduction of tongue mass or the advancement of tongue attachments. The genioglossus and the digastric muscles are repositioned anteriorly which results in a more anterior position of tongue and also a change in position of the geniohyoid muscle which pulls the hyoid bone superiorly.¹¹ This is done in patients with a Respiratory Distress Index (RDI) of above 15 per

hour of sleep and patients who are reluctant to the use of CPAP. This procedure may also be done in combination with UPPP or MMA in patients with multiple obstructions.

2. Distraction Osteogenesis (DO)- is a technique developed by Ilizarov for the correction of deformities of limbs and was later adapted to maxillofacial surgery for the correction of facial deformities using advancement procedures. The technique has five phases: surgery, latency, consolidation, and removal of appliance. Lu et al. described DO as a reliable surgical technique to improve narrow upper airway in young patients. Advancement upto 25 mm has been reported and relapse is comparatively less compared to conventional osteotomies.¹² It is better to advance the mandible using DO because the procedure can be stopped once the desired advancement is achieved and the gradual incremental movements also provides accommodation for the soft tissues, thereby increasing stability, preventing nerve damage and also protecting the temporomandibular joint.

3. Maxillo-mandibular advancement (MMA) - considered as a phase II therapy because of its aggressive nature, is considered the most predictable surgical treatment. Patients with severe Maxillofacial skeletal deformity are the best candidates. It causes an expansion in the skeletal framework including the nasal, pharyngeal and hypopharyngeal airways leading to airway expansion and reduces lateral pharyngeal wall collapse. Patients with severe maxillo-mandibular deficiency, young patients with OSA who needs a permanent correction, patients who prefer a single stage surgery are thought to be ideal candidates for MMA.¹³ Surgeries include: Maxillary advancement with Le Fort I osteotomy which pulls forward the velum and velopharyngeal muscles along with the maxilla.

Mandibular advancement with bilateral sagittal split osteotomy (BSSO) along with genioplasty advances the tongue and the suprahyoid muscles along with the mandible. Maxilla is advanced first followed by the mandible which is moved into occlusion. There is a 70-100% success rate with 90% improvement in the quality of life in those who had MMA.¹⁴ The limitation is that

advancement of more than 10-12 mm is not possible due to soft tissue limitations and the tendency to relapse with larger advancements. It is an invasive and complex surgery with potential complications such as profuse bleeding, infection, paresthesia, occlusal disharmony and esthetic changes.

Conclusion

OSA is a common disorder which can lead to serious complications, but not diagnosed routinely. It requires a multidisciplinary approach for the proper diagnosis and management. There are different modalities for the treatment ranging from behavioral management to invasive surgical procedures. Oral appliance therapy is less effective compared to CPAP therapy. Sleep apnoea surgery has advanced with new surgical techniques and instruments. Dentists must be able to recognize the disease by early evaluation and propose a treatment plan or refer to a specialist for further definitive treatment.

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